

CLAIMS

[1] A rare earth magnet comprising:

a magnet body containing rare earth element and

an amorphous layer formed on the magnet body, wherein

5 the amorphous layer contains all of elements constituting the magnet body.

[2] A rare earth magnet comprising:

a magnet body containing rare earth element and

an amorphous layer formed on the magnet body, wherein

10 the amorphous layer is the one produced by amorphization of the magnet body.

[3] The rare earth magnet according to claim 1 or 2, further comprising

a passivation layer passivated by a chemical conversion treatment of the amorphous layer on the amorphous layer.

15 [4] A rare earth magnet comprising:

a magnet body containing rare earth element

a substantial amorphous layer formed on a surface of the magnet body;
and

20 a protecting layer formed on the surface of the amorphous layer, wherein

the amorphous layer contains element identical to main component element of magnet material contained in the magnet body.

[5] The rare earth magnet according to any one of claims 1 to 4, wherein the magnet body is polycrystal.

25 [6] The rare earth magnet according to any one of claims 1 to 5, wherein a composition ratio of the elements contained in the amorphous layer is

substantially identical to that of main component elements contained in the magnet body.

[7] The rare earth magnet according to any one of claims 4 to 6, wherein an arithmetic mean roughness Ra of the surface of the protecting layer side of the amorphous layer ranges from 0.1 to 1.5 μm .

[8] The rare earth magnet according to any one of claims 1 to 7, wherein the amorphous layer is obtained by bombarding the surface of the magnet body with solid particles or particle beams to denature vicinity of the surface of the magnet body.

[9] The rare earth magnet according to any one of claims 1 to 8, wherein the amorphous layer has a thickness of 0.01 to 20 μm .

[10] A rare earth magnet comprising:

a magnet body containing rare earth element;

a substantial amorphous layer obtained by bombarding the surface of the magnet body with solid particles or particle beams to denature vicinity of the surface of the magnet body; and

a protecting layer formed on the surface of the amorphous layer.

[11] The rare earth magnet according to any one of claims 4 to 10, wherein the protecting layer comprises metal, metal oxide, metal nitride, oxynitride, chemically converted film, or resin.

[12] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer comprises at least one kind of elements selected from a group composed of aluminum, tantalum, zirconium, hafnium, niobium, silicon, titanium, magnesium, chromium, nickel, barium, molybdenum, vanadium, tungsten, zinc, strontium, iron, bismuth, boron, calcium, gallium, germanium, lanthanum, lead, and

indium.

[13] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer comprises an oxide of at least one kind of elements selected from a group composed of aluminum, tantalum, zirconium, hafnium, niobium, silicon, titanium, magnesium, chromium, nickel, barium, molybdenum, vanadium, tungsten, zinc, strontium, iron, bismuth, boron, calcium, gallium, germanium, lanthanum, lead, or indium.

[14] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer comprises an nitride of at least one kind of elements selected from a group composed of silicon, aluminum, tantalum, titanium, zirconium, hafnium, niobium, magnesium, chromium, nickel, molybdenum, vanadium, tungsten, iron, boron, gallium, germanium, bismuth, manganese, barium, lanthanum, yttrium, calcium, strontium, cerium, and beryllium.

[15] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer comprises an oxynitride of at least one kind of elements selected from a group composed of silicon, aluminum, tantalum, titanium, zirconium, hafnium, niobium, magnesium, chromium, nickel, molybdenum, vanadium, tungsten, iron, boron, gallium, germanium, bismuth, manganese, barium, lanthanum, yttrium, calcium, strontium, cerium, and beryllium.

[16] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer is a chemically converted film containing at least one kind of elements selected from a group composed of chromium, cerium, molybdenum, tungsten, manganese, magnesium,

zinc, silicon, zirconium, vanadium, titanium, iron, and phosphorus.

[17] The rare earth magnet according to any one of claims 4 to 11, wherein the protecting layer comprises at least one kind of a resin selected from a group composed of phenolic resin, epoxy resin, melamine resin, and xylene resin.

[18] A method of manufacturing a rare earth magnet, comprising an amorphization process of amorphizing a surface layer of a polycrystal magnet body containing rare earth elements.

[19] The method of manufacturing a rare earth magnet according to claim 18, wherein in the amorphization process, a shock is given to the surface layer of the magnet body to amorphize the surface layer of the magnet body.

[20] The method of manufacturing a rare earth magnet according to claim 19, wherein in the amorphization process, a particle group is bombarded to the surface layer of the magnet body.

[21] The method of manufacturing a rare earth magnet according to any one of claims 18 to 20, wherein in the amorphization process, a part from 0.1 to 20 μm in a depth from the surface of the magnet body is amorphized.

[22] The method of manufacturing a rare earth magnet according to any one of claims 18 to 21, further comprising a chemical conversion treatment process, in which the surface layer of the amorphized layer is subjected to a chemical conversion treatment to form a passivation layer, after the amorphization process.

[23] The method of manufacturing a rare earth magnet according to claim 22, wherein in the chemical conversion treatment process, the

surface layer of the amorphized layer is contacted to at least one of nitric acid, an aqueous solution of zinc phosphate, oxygen plasma and ozone.

5 [24] A method of manufacturing a rare earth magnet comprising a bombarding process of bombarding a surface of a magnet body containing rare earth elements with solid particles or particle beams and a protecting layer forming process of forming a protecting layer on the surface of the magnet body after the bombarding process.

10 [25] The method of manufacturing a rare earth magnet according to claim 24, wherein in the bombarding process, solid particles or particle beams are bombarded to deform vicinity of the surface of the magnet body to form an amorphous layer.

15 [26] The method of manufacturing a rare earth magnet according to claim 24 or 25, wherein the particle beam is neutral particle beam, ion beam, molecular beam, or radical beam.

[27] The method of manufacturing a rare earth magnet according to claim 26, wherein the particle beam is generated by plasma discharge.

20 [28] A method of manufacturing a multilayer body, wherein solid particles or particle beams are bombarded against a surface of a magnet body containing rare earth elements to denature vicinity of the surface of the magnet body to a substantial amorphous layer.

[29] The method of manufacturing a multilayer body according to claim 28, wherein the particle beams are neutral particle beam, ion beam, molecular beam, or radical beam.

25 [30] The method of manufacturing a multilayer body according to claim 29, wherein the particle beams are generated by plasma discharge.